

Climate-Change Problem Solving: Structured Approaches Based on Real-World Experiences

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Outline

- Model of knowledge system
- Structured problem solving
- How to express problem solving in information technology
- Concrete design example:
 - Development of quasi-controlled vocabulary
 - Narrative information
- Conclusions: Major Design Considerations
- Draw a single thread through a complex problem

Knowledge System

- Need to bring together disparate information and different points of view to develop strategies for applied problem solving
- Key to development of successful strategies: iterative process or co-development with information providers and information users

[Cash et al: 2002](#)

[Lemos & Morehouse, 2005](#)

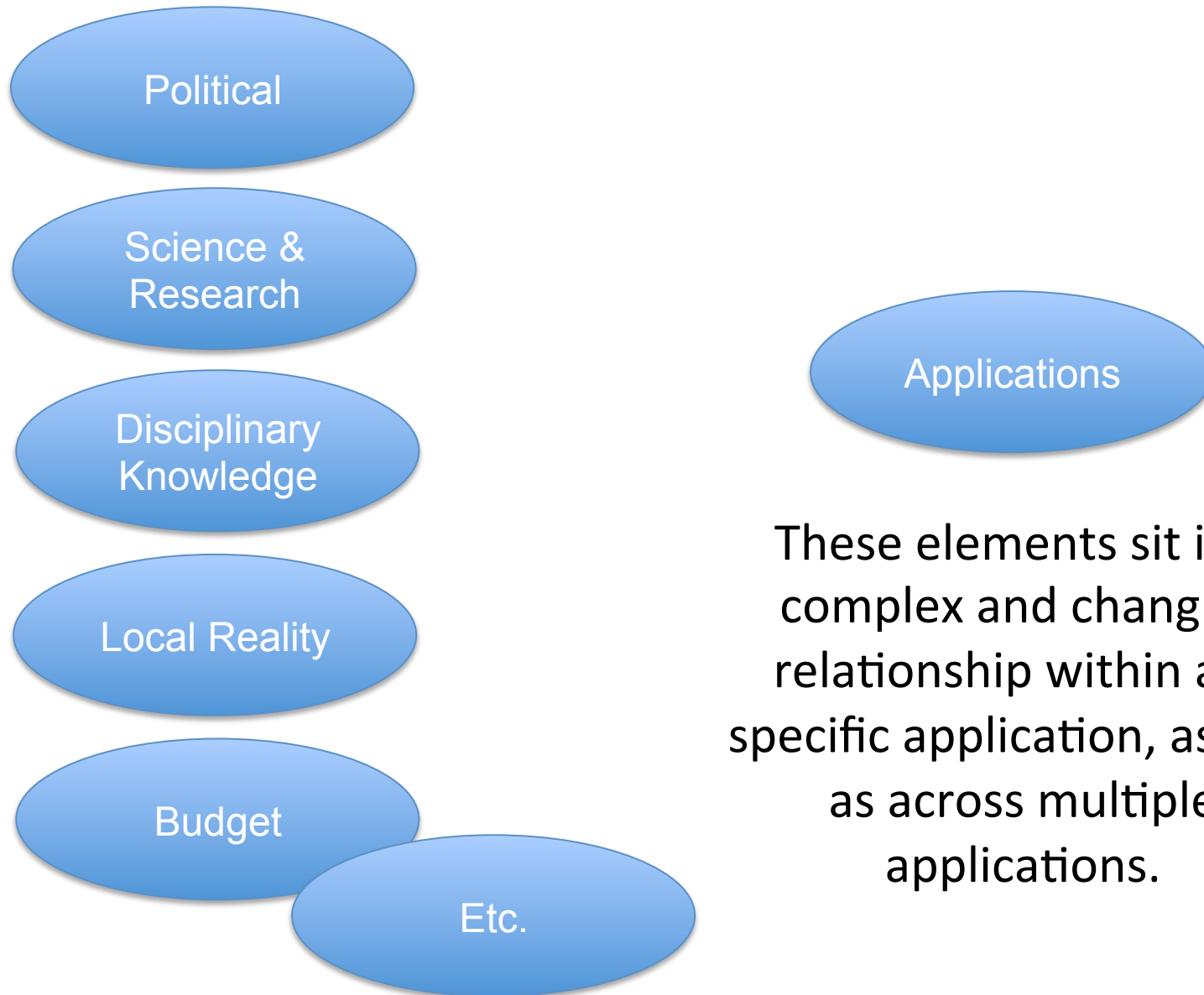
[Dilling & Lemos, 2011](#)

Knowledge System, Science Focused

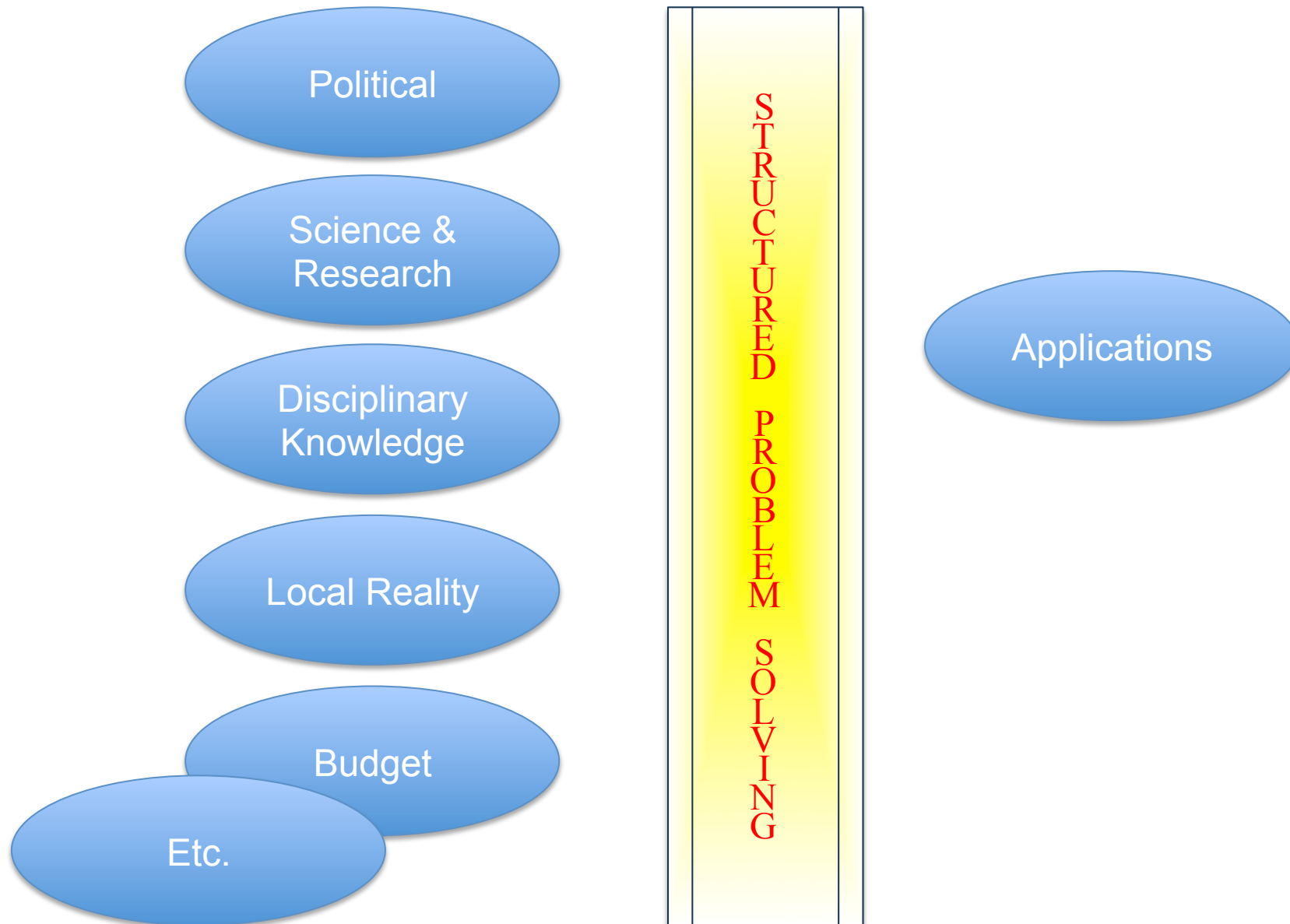


- Two Points
 - This figure overstates the role of “science” in the knowledge systems
 - I choose not to draw a line between the two bubbles, as the relation between “science” and the application is not direct.

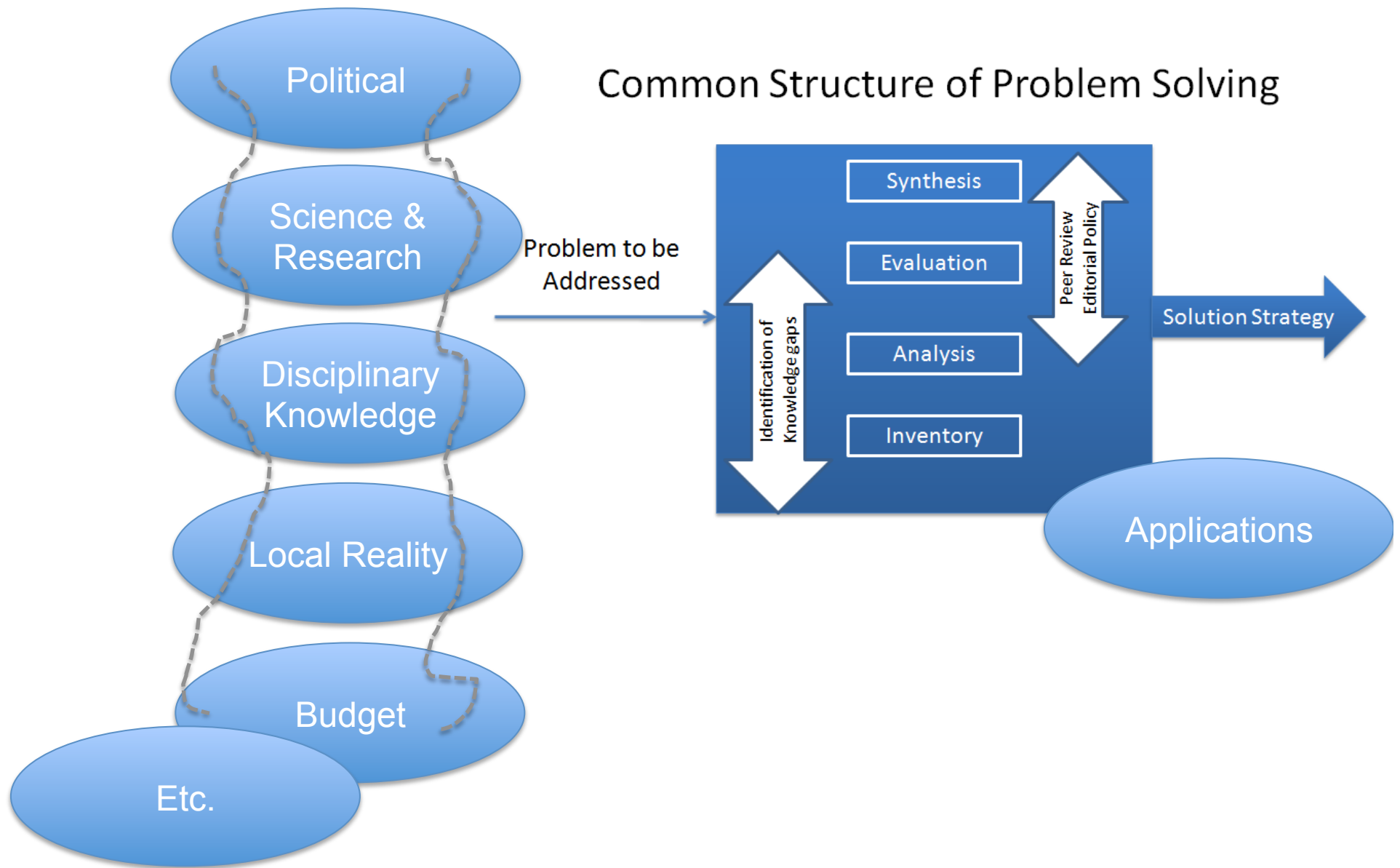
Heuristic Knowledge System



Heuristic Knowledge System



Common Structure of Problem Solving



Definitions: Structured Problem-solving

- **Inventory** is the collection of the necessary information to address the problem.
- **Analysis** is the consideration of the nature of the information: deconstruction - breaking down the information, identifying relationships, determination of information gaps ...
- **Evaluation** is the determination of the quality and value of the information: accuracy, relevancy, defensibility, validation ...
- **Synthesis** is the fitting together of the information resulting from the above problem solving processes to address a specific problem: reconstruction, integration, creation of new knowledge

How to support this in IT?

- Inventory is easy to conceive as a database with a content management system
 - How to extend this to support
 - Analysis
 - Evaluation
 - Synthesis



Capture Expertise of People Solving the Problem

- Tag information (range of descriptors)
- Translate information across disciplinary boundaries
- Tailor information to be relevant to specific application
- Describe uncertainty
- Provide judgment on usability of information
- → Knowledge applied to real problems

Focus on those directly vested in problem solving.

The way we have chosen to pursue this
(GLISAclimate.org)

- Faceted Search
- Blog
- Wiki



Drupal: Open Source Content Management
Apache Solr: Open Source Search

Vocabulary for Faceted Search

- Controlled or defined vocabulary
- User provided vocabulary

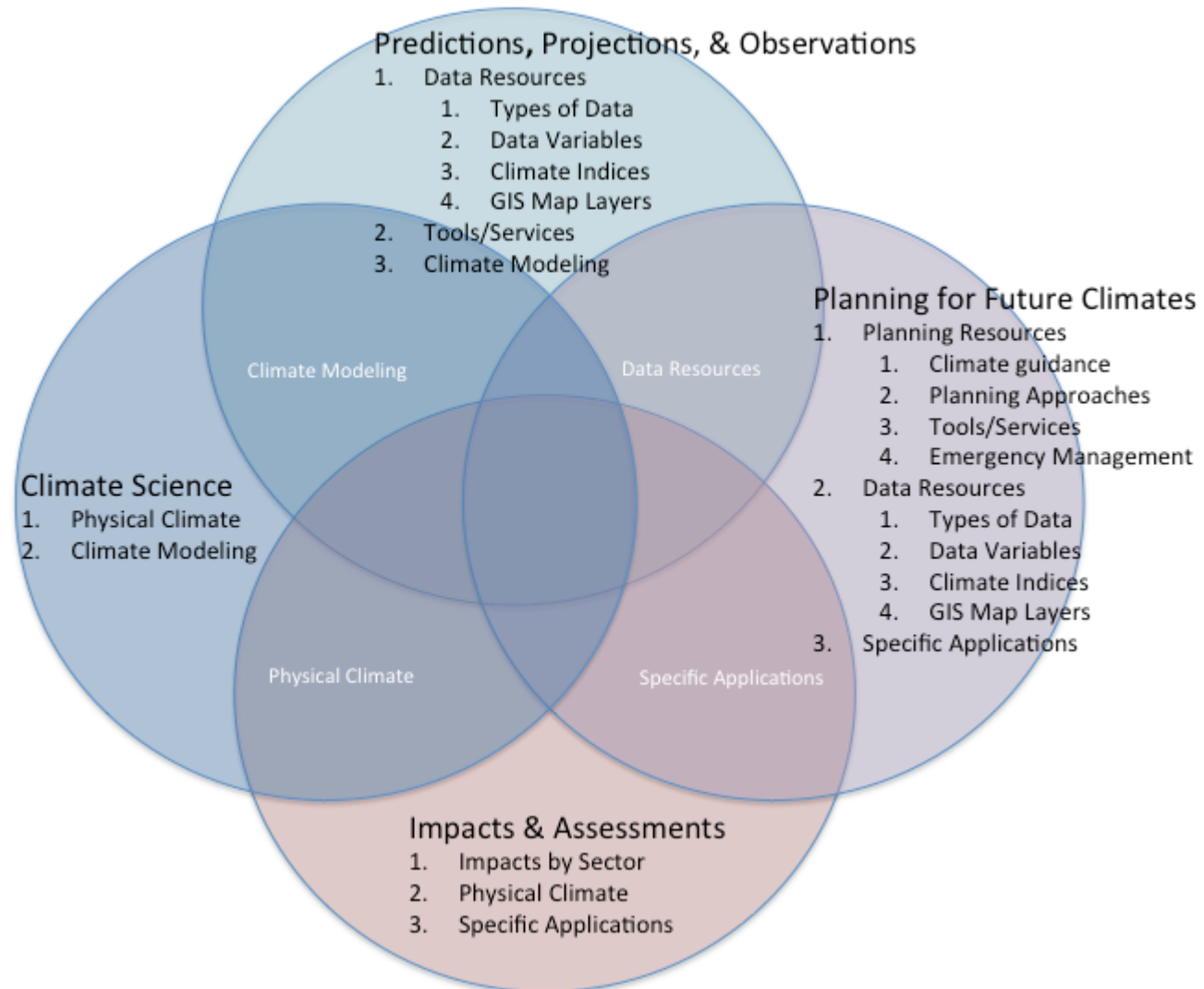
We have chosen a design of quasi-controlled vocabulary.

Co-developed with initial users

Limit terms to promote usability

Especially at the top, first levels

Development of Controlled Vocabulary



Search: GLISAclimate.org

The image shows a screenshot of the GLISAclimate.org search interface. On the left side, there are three filter panels: 'Recommended by Others' with options for 'true (119)' and 'false (168)'; 'Media Type' with a list of document types and counts (e.g., 'Journal Article (refereed) (189)', 'Website (35)', etc.); and 'Great Lake-Specific Resources' with options for 'false (259)' and 'true (88)'. Below these is another filter panel 'Includes Narratives' with options for 'false (272)' and 'true (103)'. The main content area features a breadcrumb trail: 'GLISA Projects' > 'Climate Science' > 'Impacts & Assessments' > 'Planning for Future Climates' > 'Predictions, Projections, and Observations'. Below this is a sub-menu: 'Impacts By Sector' > 'Physical Climate' > 'Specific Applications'. A list of sectors with counts is displayed: Agriculture (20), Business (7), Economy (11), Energy (14), Environment (38), Health (22), Infrastructure (12), Land Use (8), Policy (14), Tourism (12), Transportation (11), Urban (11), and Water (91). At the bottom, there is a search bar with the placeholder text 'Enter your keywords' and a search button. The text 'Search results' is visible below the search bar. Four blue arrows point to specific parts of the interface: 'Top Layer' points to the breadcrumb trail; 'Overlap at Top' points to the sub-menu; 'Sector Facets' points to the list of sectors; and 'General Page or Site Search' points to the search bar.

Recommended by Others

- true (119)
- false (168)

Media Type

- Journal Article (refereed) (189)
- Website (35)
- Data Portal (26)
- Report (25)
- White Paper (10)

Show more

Great Lake-Specific Resources

- false (259)
- true (88)

Includes Narratives

- false (272)
- true (103)

GLISA Projects Climate Science Impacts & Assessments

Planning for Future Climates Predictions, Projections, and Observations

Impacts By Sector Physical Climate Specific Applications

- Agriculture (20)
- Business (7)
- Economy (11)
- Energy (14)
- Environment (38)
- Health (22)
- Infrastructure (12)
- Land Use (8)
- Policy (14)
- Tourism (12)
- Transportation (11)
- Urban (11)
- Water (91)

Enter your keywords

Search results

Top Layer

Overlap at Top

Sector Facets

General Page or Site Search

Support Co-development: GLISAclimate.org

The screenshot shows the GLISAclimate.org website interface. On the left, there are four filter panels: 'Recommended by Others', 'Media Type', 'Great Lake-Specific Resources', and 'Includes Narratives'. The main content area features a navigation menu with 'GLISA Projects', 'Climate Science', and 'Impacts & Assessments'. Under 'Impacts & Assessments', there are sub-categories: 'Planning for Future Climates' and 'Predictions, Projections, and Observations'. A list of topics is displayed, including Agriculture (20), Business (7), Economy (11), Environment (38), Health (22), Infrastructure (12), Land Use (8), Policy (14), Tourism (12), Transportation (11), Urban (11), and Water (91). At the bottom, there is a search bar labeled 'Enter your keywords' and the text 'Search results'. Three blue arrows point from the filter panels to the main content area, each with a descriptive label: 'Recommended: Value of Usability' points to the 'Recommended by Others' panel, 'Media Type: Contributes to Evaluation' points to the 'Media Type' panel, and 'Narrative Information: Translation, Tailoring, Description, Usability' points to the 'Includes Narratives' panel.

Recommended by Others

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- false (168)

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Great Lake-Specific Resources

- false (259)
- true (88)

Includes Narratives

- false (272)
- true (103)

Navigation: GLISA Projects, Climate Science, Impacts & Assessments

Sub-categories: Planning for Future Climates, Predictions, Projections, and Observations

Topics:

- Agriculture (20)
- Business (7)
- Economy (11)
- Environment (38)
- Health (22)
- Infrastructure (12)
- Land Use (8)
- Policy (14)
- Tourism (12)
- Transportation (11)
- Urban (11)
- Water (91)

Annotations:

- Recommended: Value of Usability
- Media Type: Contributes to Evaluation
- Narrative Information: Translation, Tailoring, Description, Usability

Enter your keywords

Search results

Conclusion: Major Design Considerations

(<http://www.glisacclimate.org>)

- Support iterative co-development
 - Focus on those actively engaged in process
- Information is not hierarchical
 - “Science” only part of knowledge base
- Fundamental elements of problem solving
 - Inventory, Analysis, Evaluation, Synthesis
- Quasi-controlled vocabulary
 - Classification, usability
- Free-form narrative information and tags
 - Analysis, Evaluation, Synthesis
 - Iterative Co-development